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ABSTRACT

Three experiments investigated the development in young children of two concepts: the antecedent possibilities for reflexives (e.g., himself or herself) and pronouns (e.g., him or her). In the first experiment, 156 English-speaking children aged 2;6 to 6;6 and 21 adults were tested for their understanding of antecedents within reflexive sentences, pronoun sentences, and gender-control pronoun sentences. The results for reflexive sentences were as predicted by the Lexical Learning Hypothesis, but the pronoun sentence results were not. Following up this earlier experiment with similar subject groups, the second study tested infinitival structures and gender control for reflexives and the third tested whether the youngest children had the linguistic knowledge that reflexives and pronouns need non-local antecedents. In general, when relative patterns rather than absolute scores or ages are considered, the results of the later studies replicated the results of the earlier experiment: when the target task is to make coreference judgments between the reflexive or pronoun and the two sentence-internal antecedents, children do differentiate reflexive from pronoun sentences in all experiments, regardless of complement type and the different tasks required. However, a developmental delay in acquisition of non-locality condition for pronouns suggests a need for additional investigation of the Lexical Learning Hypothesis. (MSE)

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CHHILDREN'S ACQUISITION OF THE LOCALITY CONDITION FOR REFLEXIVES AND PRONOUNS

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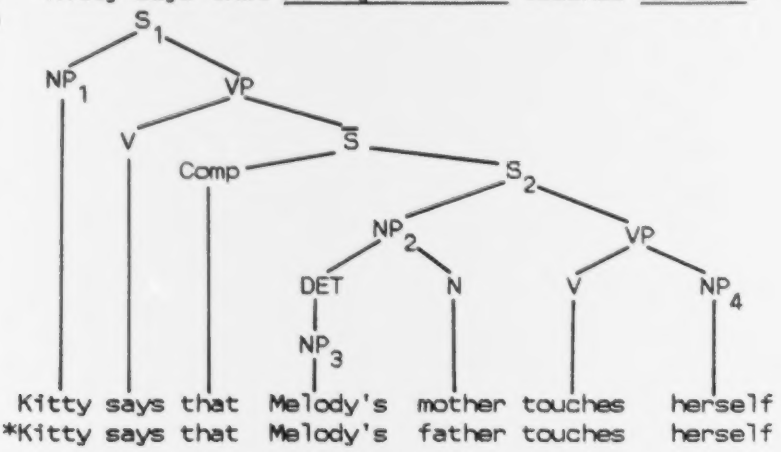
In this paper, we present three experimental studies which are designed to reveal the development of two important concepts, namely the antecedent possibilities for reflexives (e.g., himself or herself) and pronouns (e.g., him or her). These two concepts are relevant to the universal Binding Principles A and B involved in the Government and Binding theory proposed by Chomsky (1981). In Wexler & Chien (1985), Binding Principle A is informally redefined as following: "a reflexive must be locally bound". Three crucial structural properties are involved in this definition. The reflexive must have an antecedent, this antecedent must be local, and it must c-command the reflexive.

Sentences (1) and (2) and the corresponding phrase-marker (3) illustrate the three structural properties.

(1) Kitty says that Melody's mother touches herself.

(2) *Kitty says that Melody's father touches herself.

(3)



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In sentences (1) & (2), there are three possible antecedents for the reflexive "herself". They are (NP_1) "Kitty", (NP_2) "Melody's mother" (or "father"), and (NP_3) "Melody". By applying a simple definition of c-command and a simple definition of locality, as stated in (4), to the structural configuration (3), we find that only "Melody's mother" (or "father") locally c-commands the reflexive "herself". "Kitty" is not a local antecedent.

(4) C-Command: In a phrase-marker, node A c-commands node B if and only if the first branching node which dominates A also dominates B.
Locality: (for our purposes here) in the same clause as.

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Sentence (1) is grammatical because the antecedent which locally c-commands the reflexive (i.e., "Melody's mother") has the same gender as the reflexive. Sentence (2), is ungrammatical because the local antecedent "Melody's father" does not carry the same gender as the reflexive "herself", so there is no antecedent for "herself".

In contrast to Principle A, Principle B states that a pronoun may not be locally bound. This implies that, within a sentence, a pronoun may refer only to a non-local c-commanding antecedent, or a non-c-commanding antecedent. By replacing the reflexive "herself" in (1) with the pronoun "her", we derive the pronoun sentence (5).

(5) Kitty says that Melody's mother touches her.

In (5), both "Kitty" and "Melody" are possible antecedents for the pronoun "her". With the additional possibility that a pronoun may refer to a sentence-external reference in the discourse, sentence (5) is ambiguous in three ways.

In this paper, we are concentrating only on the child's knowledge of the locality condition.

Previous Empirical Results

In our previous study, we tested 156 English-speaking children between the ages of 2;6 and 6;6 and 21 adults by using a version of the act-out task similar to the "Simon-Says" game (Wexler & Chien, 1985). Three sentence types were included: reflexive sentences (e.g., 6), pronoun sentences (e.g., 7) and gender control (GC) pronoun sentences (e.g., 8).

(6) {Kitty / Snoopy} says that {Sarah / Adam} should point to {herself / himself}.

(7) {Kitty / Snoopy} says that {Sarah / Adam} should point to {her / him}.

(8) {Snoopy / Kitty} says that {Sarah / Adam} should point to {him / her}.

As can be seen from (6)-(8), each test sentence involved a matrix verb "say" and a tensed complement. Sentences with "Sarah" were designed for female subjects; those with "Adam" were designed for male subjects. In our experiments, "Sarah" was replaced by the name of the girl who was tested; "Adam" was replaced by the name of the boy who was tested. In the test sentences, there were two potential antecedents for the following reflexives or pronouns. Among these two potential antecedents, only the child's name (e.g., "Sarah" or "Adam") locally c-commands the reflexive or the pronoun; the matrix subject NP (e.g., "Kitty" or "Snoopy") does not.

In the "Simon-Says" game, the experimenter held two puppets (e.g., "Snoopy" & "Kitty") and read a test sentence such as (6). The child was asked to perform an action whenever he/she heard "Kitty says" or "Snoopy says". The results are illustrated by the lines with small squares in Figures (1) to (4). On the abscissa we plot ages in six-month intervals. Group 1 consists of children between the ages of 2;6 and 3;0 (years; months). Group 8 consists of children from 6;0 to

6;6. At least 15 subjects were tested in each group. On the ordinate we plot percentage of correct items. The major findings of this study are summarized as follows:

(A) In Figure 1, the line with small squares shows that children older than 6;0 (G8) know the major property of reflexives that the antecedent must be local. Their percentage correct is 90%. This line also indicates that children's performance on the locality property of reflexives increases continuously from about the 13% level at age 2;6 to almost perfect performance at 6;0.

(B) In Figure 3, the line with squares indicates that children in the age range of 6;0 to 6;6 still do not have the knowledge that a pronoun may not have a local c-commanding antecedent. Group 8 children show only 64% correct. That is, about 36% of the time these children violate principle B. Since chance performance is 50%, the children demonstrate at best only a little knowledge of Principle B. This line also indicates that children's performance on the requirement that pronouns may not have a local c-commanding antecedent stays roughly flat from 2;6 to 6;6, with only a slight improvement. This flat curve is in direct contrast to the steady increase for the reflexive.

(C) In Figure 4, the line with the squares shows that, when there is a gender match between the pronoun and its correct non-local c-commanding antecedent, children pay attention to this gender matching cue and make correct judgments perfectly. Even the youngest children (2;6-3;0) are 80% correct. These results show that Principle B is not constraining the children. The pronouns can take either antecedent and the children use other cues to determine their choice. Gender for pronouns is very well established.

The Lexical Learning Hypothesis proposed by Wexler & Manzini (1987) [based on Borer's (1984) hypothesis that languages vary only in their lexical and morphological properties] was adopted to interpret these developmental results. According to this hypothesis, Principles A and B are unlearned; they are part of the innate endowment that the child brings to the language acquisition task. Lexical items, on the other hand, are learned. This implies that, as long as the child learns that "herself/himself" is a reflexive, and "her/him" is a pronoun, he/she should be able to link these two lexical items to the corresponding principles and to correctly identify their antecedents.

From the stand-point of the Lexical Learning Hypothesis, the developmental results for our reflexive sentences are predicted. That is, a certain period of time is expected and required for a child to complete the learning task that "herself/himself" is a reflexive. This learning, according to our results, is completed around the age of 6;0 (i.e., the age by which almost perfect performance is observed). The question remaining unsolved, however, is why the youngest children consistently choose a non-local antecedent for the

reflexive. That is, why are the Group 1 children only 13% correct, instead of about 50% correct, which is the chance expectation? Does this represent part of children's grammatical knowledge at this age, or are other pragmatic factors (e.g., saliency of the puppet in the experiment) determining the results at this age?

The developmental results for our pronoun sentences, on the contrary, are not consistent with the prediction generated by the Lexical Learning Hypothesis. Only very little improvement from the youngest to the oldest children is observed. At the age of 6;6, there are still a large number of violations of the requirement that pronouns may not have a local c-commanding antecedent. The question is then, "at what age, will this learning be completed and why is there such a time lag between the learning of reflexives as reflexives and that of pronouns as pronouns?"

The Current Experiments

There are at least three questions which we seek to study in the following two experiments:

(A) It has been claimed by Solan (1987) that children show different binding effects between sentences with infinitival complements and sentences with tensed complements. Our previous experiment used tensed complements. In order to test these differential effects on binding, in the succeeding experiment, we employed sentences containing the matrix verb "want" and an infinitival complement using exactly the same methodology, namely the "Simon-Says" game, and a different methodology (the "Party" game).

(B) We wish to replicate and to investigate in more detail the results from our previous study, especially, those involving the younger children's responses to the reflexive sentences and the older children's responses to the pronoun sentences. First, we want to find out why young children, when dealing with reflexive sentences, systematically choose the "long-distance" non-local antecedent. Second, the violation of Principle B result seems so important that we want to investigate whether the result holds up using different experimental methods and with different linguistic materials.

(C) Children's almost perfect responses to the Gender Control Pronoun sentences indicate that children do pay attention to this extra cue. In our succeeding experiments, an additional sentence type, namely the Gender Control Reflexive sentences, is included. This is designed to investigate whether gender also provides an efficient cue to reflexive sentences.

Experiment One

Experiment One was designed to test infinitival structures and

to also use the gender control for reflexives. We tested 142 children (between the ages of 2;6 and 6;6, with a mean age of 4;5) and 20 adults on the "Simon-Says" game. Four sentence types were included: reflexive sentences (e.g., 9), pronoun sentences (e.g., 10), GC reflexive sentences (e.g., 11) and GC pronoun sentences (e.g., 12). All sentences included in this experiment contained the matrix verb "want" and an infinitival complement.

(9) {Kitty / Snoopy} wants {Sarah / Adam} to point to {herself / himself}.

(10) {Kitty / Snoopy} wants {Sarah / Adam} to point to {her / him}.

(11) {Snoopy / Kitty} wants {Sarah / Adam} to point to {herself / himself}.

(12) {Snoopy / Kitty} wants {Sarah / Adam} to point to {him / her}.

In the test sentences, there were two potential antecedents for the following reflexives or pronouns. In these sentences, only the child's name (e.g., "Sarah" or "Adam") locally c-commands the reflexive or the pronoun; the matrix subject NP (e.g., "Kitty" or "Snoopy") does not. Five different actional verbs ("touch", "point to", "scratch", "pat" and "tickle") were included. There were two items for each verb, yielding a total of 10 sentences for each sentence type and a total of 40 test items for each subject.

The results of this experiment are illustrated by the lines with small crosses in Figures (1) to (4). In general, these results replicate the results indicated in our previous study. The major findings are summarized as follows:

(A) In Figure 1, the line with crosses shows that children older than 5;6 (i.e., the G7 & G8 children) know the major property of reflexives when dealing with the "want-reflexive" sentences consisting of infinitival complements. We find that the knowledge that the reflexive must have a local antecedent is revealed at a slightly earlier age with these "want-reflexive" sentences than the "say-reflexive" sentences which involve tensed complements. The line with the crosses in Figure 1 also indicates that children's performance on the "locality" property of reflexives continuously increases from about 36% at age 2;6 and approximates the adult's level around age 5;6. In many cases, the youngest children choose the non-local antecedent for the reflexive. These results replicate the results of our previous study.

(B) In Figure 3, the line with small crosses indicates that children in the same age range (5;6 to 6;6) still do not show the knowledge that a pronoun may not be c-commanded by its local antecedent. Their performance on the requirement that pronouns may not have a local c-commanding antecedent does not change too much in the age range we have studied (2;6 to 6;6). In our oldest age group, it still remains at

The Results

The 'Simon-Says' Game

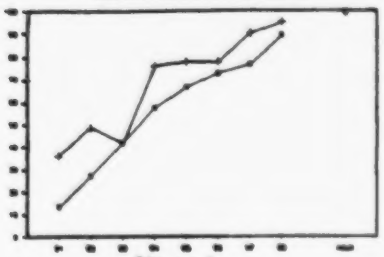

Figure 1

The 'Party' Game

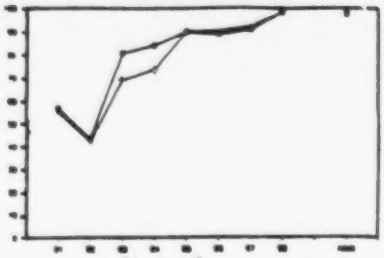

Figure 5

R: CR between R and the Local C-C Antecedent (i.e., CR-C) [Correct Responses]

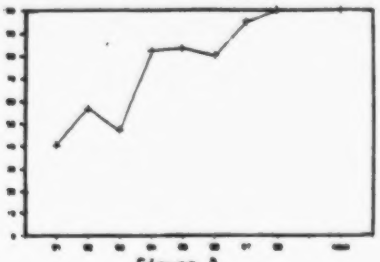

Figure 2

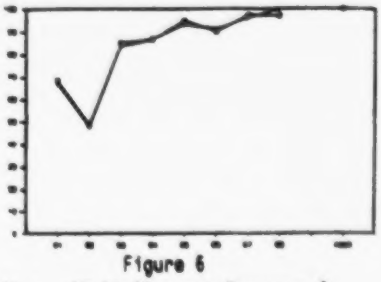

Figure 6

GCR: CR between R and the Local C-C Antecedent (i.e., CR-C) [Correct Responses]

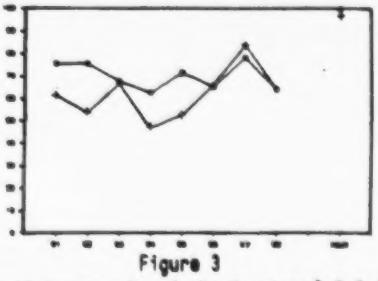

Figure 3

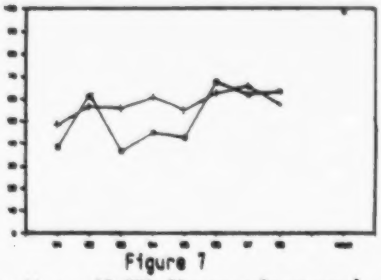

Figure 7

P: CR between P and the Non-Local C-C Antecedent (i.e., CR-PM) [Correct Responses]

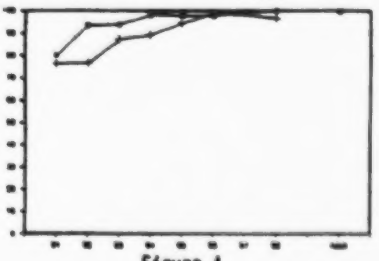

Figure 4

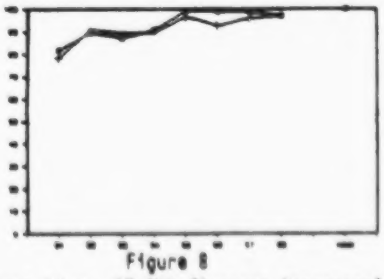

Figure 8

GCP: CR between P and the Non-local C-C Antecedent (i.e., CR-PM) [Correct Responses]

Abscissa: Age Groups [G1-G8 (6 mons. interval) and Adult]
Ordinate: % of Items

Say:	■—■	Want:	←—→
R:	Reflexive	P:	Pronoun
GCR:	Gender Control Reflexive	GCP:	Gender Control Pronoun
CR:	Coreference Judgement	C-C:	C-Commanding
CR-C:	Coreference with the Child	CR-PM:	Coreference with the Puppet Mentioned

only about 64% correct. These results again replicate our previous results.

(C) Comparing the line in Figure 2 with the line with small crosses in Figure 1, we find that gender match between the reflexive and its local c-commanding antecedent does not help children too much in making correct coreference judgments. Gender match between the pronoun and its non-local antecedent, however, has a strong effect on the pronoun responses, as Figure 4 shows. The result regarding children's responses to the GC pronoun sentences also replicates the result of our previous study.

Experiment Two

Our second experiment was designed to test whether the youngest children believed as a matter of linguistic knowledge that reflexives and pronouns need non-local antecedents. We reasoned that, if we could manipulate the children's responses by pragmatic cues, their behavior in our earlier experiments was most likely a response bias, rather than a demonstration of linguistic knowledge. For example, perhaps the two-and-a-half-year olds would rather point at a puppet than themselves in our task. Therefore we created the "Party" game, a situation in which we expected the response bias to be eliminated or decreased by making the local response (an act of giving to oneself) more attractive to the child.

We tested 174 children (in the same age range as in Experiment One) and 20 adults in the "Party Game". The experimenter set up a situation in which a female and a male puppet were sitting in front of the child. A big plate containing different small toys or props was put in the middle of a table between the child and the puppets. In front of the child and each puppet, there was an empty bowl for them to keep toys. The child was expected to take a small toy from the center plate and put it into either his/her own bowl or one of the puppet's bowls, according to the sentence presented to him/her. Four sentence types were included: reflexive sentences (e.g., 13), pronoun sentences (e.g., 14), GC reflexive sentences (e.g., 15) and GC pronoun sentences (e.g., 16). Half of the test sentences in each type involved the matrix verb "say" which subcategorizes for a tensed complement; the other half involved the matrix verb "want" which subcategorizes for an infinitival complement. There were 4 items per condition [2 for each of two dative constructions used (e.g., X gives Y a Z or X gives a Z to Y)], yielding a total of 32 sentences for each subject.

(13) {Kitty / Snoopy} says that {Sarah / Adam} should give {herself / himself} a car.

(14) {Kitty / Snoopy} says that {Sarah / Adam} should give {her / him} a popsicle.

(15) {Snoopy / Kitty} says that {Sarah / Adam} should give {herself / himself} a cup.

(16) {Snoopy / Kitty} says that {Sarah / Adam} should give {him / her} a whistle.

The results regarding the say-sentences are illustrated by the lines with small squares in Figures 5 to 8; those regarding the want-sentences are illustrated by the lines with small crosses in the same figures. The major findings are summarized as follows:

(A) Concerning the reflexive sentences, a very strong within-task (i.e., the "Party" game) & between-complement-type consistency (want-infinitive vs. say-tensed) was found in this experiment. As indicated by the two lines in Figure 5, children older than 4;6 (i.e., G5 to G8 children) behave as if they know that the antecedent of the reflexive must be local. Only a slightly higher performance was found in G3 and G4 (3;6-4;6) for the say-reflexive than the want-reflexive sentences. For all the other groups, the response patterns to these two sentence types are almost the same. These two lines also show that children's performance on the locality property of reflexives increases continuously from the chance level (50%) at age 2;6 to almost perfect performance at 6;6. Compared to our previous two studies, in general, children showed higher percentage of correct responses to the reflexive sentences when the "Party" game (say: 80.25%; want: 76.75%) rather than the "Simon-Says" game (say: 57.30%; want: 57.30%) was applied. Comparing Figure 5 with Figure 1, the knowledge that the reflexive must be c-commanded by its local antecedent attained the 90% level in the age range of 4;6-5;0 (for the "Party" game) and in the age range of 5;6-6;6 (for the "Simon-Says" game). It is important to note that, when the "Party" game rather than the "Simon-Says" game was introduced, the very young children's systematic tendency to coindex the reflexive with the non-local referent disappeared. The choice of local or non-local antecedents becomes more random and close to the chance level. [For Group 1, in the "Simon-Says" game (Figure 1) the local antecedent was selected 13% and 35% for the two kinds of sentences, and in the "Party" game (Figure 5), the local antecedent was selected about 55% for both kinds of sentences.]

(B) As indicated by the two lines in Figure 7, children at 6;6 still do not show knowledge of Principle B, namely that a pronoun may not have a local c-commanding antecedent. This result is consistently found in both the say- and the want-pronoun constructions. A higher performance was found in G3 to G5 (3;6-5;0) for the want-pronoun than the say-pronoun sentences. For the other groups, the response patterns are similar for the two types of constructions. Their performance on the requirement that pronouns not have a local c-commanding antecedent again stays relatively flat from 2;6 to 6;6. For both types of constructions, it still

remains at only about 60% correct in the oldest age group. Concerning the pronoun sentences, an important and consistent finding should be noted; that is, children's Principle B violations adopt a very similar pattern in all three experiments, regardless of the between-task and between-complement-type differences. When the extra gender cue is not available, this type of anaphora mistake does not decrease as a function of age. In addition, the youngest children produced more non-local responses for the "Simon-Says" game than for the "Party" game. [For Group 1, in the "Simon-Says" game (Figure 3) the non-local antecedent was selected 75% and 61% for the two kinds of sentences, and in the "Party" game (Figure 7), the non-local antecedent was selected 38% and 48% for the two kinds of sentences.]

(C) The two lines in Figure 6, compared to the lines in Figure 5, indicate that the gender cue does not help children's coreference judgments too much when reflexive sentences are considered. The two lines in Figure 8 (compared to the lines in Figure 7), on the other hand, indicate that, with the presence of the controlled gender cue, children make correct judgments almost perfectly when the GC pronoun sentences are considered. Again, children's responses to the GC sentences replicate the results found in our previous studies.

Conclusion

To conclude, when the relative patterns rather than the absolute scores or ages are considered, the results of our current two experiments replicate most of the results found in our previous study. That is, when the target task is to make coreference judgments between the reflexive or the pronoun and the two sentence-internal antecedents, children do differentiate reflexive sentences from pronoun sentences in all experiments. They do this regardless of the different complement types in the test sentences (i.e., tensed complement or infinitival complement) and the different tasks applied in the experiments (i.e., the "Simon-Says" game or the "Party" game). Children at the youngest ages (2;6-3;6) often respond according to a response bias, and not according to a locality condition. This is true for both reflexives and pronouns. By age 6 or earlier, they have learned the locality condition for reflexives, whether the complements are tensed or infinitival. Children at this age, however, have still not learned the non-locality condition for pronouns. A developmental delay of Principle B compared to the acquisition of Principle A is consistently revealed. The Lexical Learning Hypothesis, which is confirmed by the data relative to Principle A and apparently disconfirmed by the data relative to Principle B, needs additional investigation.

There are at least three possible ways out of this dilemma.

The first one is simply to challenge the Lexical Learning Hypothesis. Instead of stating that only lexical properties are learned, one may argue that principles are also learned, and Principle B is harder to learn than Principle A. It seems extremely unlikely that this suggestion could be correct, because correct coindexing between the reflexives or pronouns and their antecedents requires the child to have the ability to converge on knowledge that is not clearly provided by the input data. To hold the argument that principles are learned, one would have to specify what actually constitutes the positive evidence for the child to derive abstract structural notions such as "bound" and "c-command". In addition, one would still need to explain how these principles are learned and why Principle B is more difficult to learn than Principle A. In particular, notice that if a child does not have Principle A or B, there is no positive evidence to show him/her that he/she is wrong.

The second alternative suggests a reformulation of Principle B, and claims that children may have this (reformulated) Principle B (Wexler & Chien, 1985). The reformulation states that only pronouns as bound variables are subject to Principle B, and non-variable cases of Principle B are to be handled in different ways. Examples related to this refomulated principle are given in (17) and (18).

(17) Every bear says that John should point to him.

(18) Snoopy says that Goofy gave {a. himself / b. him} a candy and John should too.

In one reading, "him" in (17) is a bound variable (if "him" is coindexed with "every bear"). Sentence (18) involves VP-deletion. In (18a), if John should give himself (John) a candy, then the deleted VP contains a bound variable (the "sloppy" reading). If we violate Principle B by coindexing "him" with "Goofy" in (18b), then the reformulated Principle B will not allow a "sloppy" (bound variable) reading in the deleted VP (Reinhart, 1983). This "Principle B reformulation" approach is by no means an ad hoc one, because theoretical justification is independently formulated. For a detailed discussion of the theoretical issues regarding this reformulated Principle B, see Reinhart (1983) and Montalbetti & Wexler (1985). In addition, children's acquisition of the original vs. reformulated Principle B is empirically testable. For example, if children incorrectly coindex "her" with "Sarah" in sentences like (19), but rarely coindex "her" with "every bear" in sentences like (20), then we may argue that children have the reformulated Principle B but not the original one.

(19) Kitty says that Sarah should point to her.

(20) Kitty says that every bear should point to her.
(Suppose the bears are all females.)

To empirically support this argument, we may also test children on sentences with VP-deletion such as (18) (see Wexler & Chien, in preparation).

The third alternative has to do with the theory of Syntactic Maturation proposed by Borer & Wexler (1987) [see also Gleitman (1981)]. Instead of assuming that the formal principles available to

children are constant through development, this theory argues that certain principles mature. Like any other instance of biological maturation and the proposed syntactic maturation of "argument chain" (Borer & Wexler, 1987), we may suggest that certain Binding Principles also mature. The maturational theory indicates a possible way for interpreting the developmental delay of Principle B relative to Principle A. Following the maturational theory and looking more closely at the three binding principles proposed by Chomsky, a working hypothesis may be generated as follows. The three binding principles (A, B & C) all involve the notion of linking (or non-linking) between two elements (X & Y) in a sentence. For example, X can be a reflexive, pronoun or R-expression (i.e., name), and Y can be a potential antecedent. A principle involving disjointness between X and Y may mature later than one involving coreference. This will thus predict that Principles B and C will mature later than Principle A. Evidence for this prediction may be found in C. Chomsky (1969). Theoretical and empirical evidence concerning the growth of argument chain (c.f., Borer & Wexler, 1987) independently motivates the maturation approach. Further investigations will be necessary to see which if either of the two possible explanations (reformulation or maturation) is correct for our Binding Theory results, or indeed, whether a theory which integrates both of these explanations is even more correct.

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